

SUBSTITUTE SPECIFICATION

TITLE OF THE INVENTION

INFORMATION DISPLAY SYSTEM FOR DISPLAYING SPECIFIED

LOCATION WITH MAP THEREAROUND ON DISPLAY EQUIPMENT

BACKGROUND OF THE INVENTION

5 The present invention relates to an information display system, and more particularly to a navigation system providing for course guidance for a car to a predetermined place by calculating the car's position and displaying the calculated position on a map produced on a display, the 10 navigation system also providing other information of interest for a user by obtaining that information from a network, like the internet, from which various kinds of data are provided.

15 A navigation system typically shows a car's calculated position on a display, based on various sensors information. The display shows a map, the car's position at the center, based on map data stored in a CD-ROM, and by setting a target position, a course guidance to the target position is shown on the display. In the CD-ROM, various information of 20 interest to those driving in a car, such as information about sightseeing areas or information as to the location of gas service stations, is inputted and indicated on the display in response to a request by the user. In this case, necessary information should be stored beforehand in the 25 CD-ROM. However, since the CD-ROM is used only to read out

data, it is not suitable for use as a medium to store information which changes with time, for example, traffic information. Even if it is assumed that a rewritable memory is to be used temporarily for this purpose, it is
5 troublesome for the user to input such information.

In order to solve such a problem in the conventional navigation system, as disclosed in Japanese Patent Laid-open Nos. 7-105492 (1995), 7-261661 (1995), 8-139193 (1996),
10 communication equipment is provided in the car as part of the navigation equipment to receive facility data, so as to provide information which is not provided by the CD-ROM. In order to communicate with a car, however, a means of
15 effecting mobile communication, like a cellular telephone system, needs to be used. However, the data transmission speed of a cellular telephone system is slow and further, when it is used by a moving car, it is easy for the car to move out of the range of the channel of the cellular telephone system, and such a system is not suitable for sending a large quantity of data efficiently and accurately.
20 Furthermore, when the driver of the car wants to view information during driving, the driver's attention is averted from his or her driving depending on the information display method, creating a dangerous situation for the driver.

25 The information sent by a communication system should be capable of being accessed conveniently by the user, and so a good method of acquisition of such information is

needed in a display system for an automobile.

SUMMARY OF THE INVENTION

Referring to the above stated problems, an object of the present invention is to provide a navigation system by which a large amount of information may be accessed so as to suitably control the amount of information to be communicated, and wherein the received information is capable of being displayed intelligibly.

For this purpose, a navigation system is constituted with information display equipment for displaying information received through a mobile communication system, information offering equipment which obtains the information by connecting to a network and transmits the obtained information to the information display equipment, and communication equipment for effecting the transmission of the information.

The information offering equipment is connected to the network and includes a memory in which to store the information to be sent to the information display equipment, the information being obtained from information offering servers connected to the network. The information offering equipment also comprises a retrieval means to retrieve information to be provided to the user from the memory, and a communication means to transmit and receive data to and from the information display equipment, whereby a particular kind of information requested by the user via the information display equipment is retrieved from the memory

and is transmitted to the information display equipment. In order to suitably control the amount of data to be transmitted using the communication equipment, a data selection means and a data processing means may be provided.

5 The information display equipment comprises an input means to input information that the user requests, and a communications means to transmit a key word to the information offering equipment, or to receive information provided from the information offering equipment. The 10 information display equipment further comprises a map memory to store map data, a map display unit to retrieve map data from the map memory and to display a map on the display, and an icon display unit to display an icon at a position on the map where information provided from the information offering 15 equipment is to be displayed by the map display means. The information display equipment further comprises an icon select means by which a user selects an icon displayed by the display equipment, a retrieval means to retrieve information indicated by the selected icon either from the 20 information stored in a detailed information store or from detailed information sent from the information offering equipment, and a detailed information display means to display the information retrieved on the map on which the icon is displayed.

25 BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 schematic diagram of navigation system in accordance with the present invention.

Figure 2 is a block diagram of the information display equipment in the system of the present invention.

Figure 3 is a block diagram of the information offering equipment in the system of the present invention.

5 Figure 4 is a block diagram of the arithmetic processing unit of the information display equipment.

Figure 5 is a functional block diagram of the arithmetic processing unit of the information display equipment.

10 Figure 6 is a more detailed functional block diagram of the arithmetic processing unit of the information display equipment.

Figure 7 is a functional block diagram of the control unit of the information offering equipment.

15 Figure 8 is a diagram which shows a retrieve screen.

Figure 9 is a diagram which shows retrieval by using a phone number.

Figure 10 is a diagram which shows a view for setting an item retrieved with precedence.

20 Figure 11 is a diagram which shows the display of a retrieval range.

Figure 12 is a diagram which shows the range retrieved with an acquisition time.

25 Figure 13 is a diagram which shows a retrieval range when retrieving along with a path.

Figure 14 is a diagram which shows an example of a fixed form format.

Figure 15 is a diagram which shows an example of a free format.

Figure 16 is a diagram of a view which displays an icon contained by the information.

5 Figures 17(a) and 17(b) are diagrams showing an operation in which icons do not overlap.

Figure 18 is a diagram which shows a location of the information with an icon on the map top.

10 Figure 19 is a diagram which shows individual information by changing a property of the icon.

Figures 20(a) and 20(b) are diagrams showing detailed information of a selected icon.

Figure 21 is a diagram showing a view which displays detailed information of an icon selected with the map.

15 Figures 22(a) and 22(b) are diagrams showing detailed information being divided so as to be displayed into several pages.

20 Figures 23(a), 23(b) and 23(c) are diagrams which show how to come back to a former screen after offering the information.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The information provided to the user is sent from an information offering server through a network to information offering equipment, and the information that has been sent is stored in memory equipment so that it may be provided in response to a request by the user. When the user requests information, the information is retrieved from this memory

equipment according to a retrieval condition of the user and is transmitted to the information display equipment.

In the information offering equipment, data which should be transmitted to the information display equipment is selected and processed. The information requested by the user and transmitted to the information display equipment from the information offering equipment is displayed with an icon at the position on the map relevant to the information which is stored. When one of the icons displayed on the map is selected by the user, the detailed information which relates to the icon is displayed.

Referring to the drawings, one embodiment of a navigation system having information offering equipment in accordance with this invention will be explained. A navigation system according to this embodiment, as shown in Fig. 1, has information offering equipment 2 to obtain various information from information offering servers 3 connected through a network 4, such as the internet, and to provide the information to a user. The system further includes information display equipment 1 to display a car's position, to provide course guidance to the driver of the car, and to provide for presentation and display of information of interest to the user from the information offering equipment 2 according to a request of the user.

The information display equipment 1 will be explained with reference to Fig. 2. The information display equipment 1 includes an arithmetic processing unit 10, a display unit

11, a map memory 12, an internal information memory 13, a voice input and output unit 14, an input unit 15, a wheel speed sensor 16, a magnetic compass 17, a rate gyro 18, a GPS receiver 19, an icon image memory 20 and display side communication equipment 21.

5 The arithmetic processing unit 10 includes a means to calculate a current position of a moving body, such as a car in which the navigation equipment is installed, by using the information output from the sensors 16, 17, 18 and the GPS 10 receiver 19, and a means to select a most suitable road which connects the current position of the car with a target position indicated by the user and to indicate both the route and current position to the user using a sound and graphic display.

15 The arithmetic processing unit 10 sets a display domain according to the calculated current position of the moving body or according to scroll operation by the user, reads out the map data corresponding to the display domain from the map memory 12, provides graphic information from the map data being read out, and performs a graphical processing so 20 as to display the data on the display unit 11. The current position of the moving body is displayed by a mark along with graphics information corresponding to the map showing features in the neighborhood of the current position.

25 The display unit 11 operates to display graphics information provided by the arithmetic processing unit 10 and includes a cathode ray tube or a liquid crystal display

for this purpose. The arithmetic processing unit 10 is connected to the display unit by way of a signal line S11, providing Red, Green, Blue signaling or NTSC signaling. The map memory 12 reads out or writes in map data from a storage media, such as a CD-ROM or an integrated circuit card, in response to an outside indication.

5 The voice input and output unit 14 converts a message to be transmitted to the user into a voice signal, and recognizes a voice generated by the user so as to transmit 10 it to the arithmetic processing unit.

15 The input unit 15 operates to accept commands from the user, and it is constructed by, for example, a joy stick to allow scrolling of the map, an electric switch, such as a button, for input of a command, a touch panel on the display unit, etc.

20 The wheel speed sensor 16 measures the distance through which the moving body travels, from a product of the circumference of a wheel of the moving body and the revolution speed of the wheel, and measures the turning angle of the moving body from the difference between the revolution speeds of a pair of the wheels. The magnetic compass 17 detects the geomagnetic field and indicates the direction in which the moving body is moving. The gyro 18, 25 in the form of an optical fiber gyro or a vibration gyro, measures the turning angle of the moving body when the moving body turns.

The GPS receiver 19 receives a signal from GPS

satellites and calculates a current position, a moving angle and a moving direction of the moving body by measuring the distance between the moving body and the satellite and the rate of change of the distance relating to three or more satellites. These sensors and equipment are used in order to detect the current position of the moving body by navigation processing.

The icon image memory 20 stores images of icons which are used when the information obtained from the information offering equipment 2 is displayed on the map. The internal information memory 13 stores various kinds of information to offer to the user, most of the information being static information which is updated at a low frequency, for example, information concerning a sightseeing area, information as to the location of a gas station, guide information concerning hotel or motel accommodations or a leisure facility, and tariff information for a toll road.

Here, the navigation system of the present invention has a function to offer other fundamental information on a map in addition to that mentioned above, and there is provided on the map a lot of equivalent information to be offered. In other words, most of the individual information has location information which respectively corresponds with locations on the map, and the individual information is offered by assigning a location on the map thereto, and the location of the selected individual information is indicated on the map as explained in the following.

The display side communication equipment 21
5 communicates with the information offering equipment 2 and obtains information therefrom, which mainly changes with time and is updated with a high frequency, for example, traffic information, occupancy information for a hotel or a parking lot, weather information, and product information for a store, as will be explained in the following. The information provided in this way from the information offering device 2 is individual information including 10 location information respectively corresponding to locations on the map in the same way as the individual information stored in the internal information memory 13.

The communication volume which is most suitable for 15 mobile communication, which is one of the most distinctive characteristics of the present invention, is determined by not transmitting information which can be stored in the internal information memory 13 and which need not be updated frequently. Since it is possible to select the individual information which is sent information offering device 2, according to the location on the map, from the individual 20 information stored in the internal information memory 13, sufficient information can be offered, while the communication channel capacity is low, by combining the individual information to be related according to necessity.

25 In this embodiment of the present invention, the memory is divided into a map memory, an internal information memory and an icon image memory according to the kind of

information to be stored, however, it is possible to store plural kinds of information using one memory. In addition, in this embodiment of the present invention, while the memory consists of a map memory, an internal information memory and an icon image memory according to a kind of the information to be stored, one of the memories may store several kinds of information.

As shown in Figure 4, the arithmetic processing unit 10 is comprised of a central processing unit 31 to perform calculation and control the operation of each device, a random access memory 32 to store map data and calculation data temporarily, a read only memory 33 to store the system program, a DMA unit 34 to execute direct data transfer between one memory and another memory at high speed and between the memory and each device, a display controller 35 to generate graphics information so as to develop vector data for an image at high speed, a VRAM 36 to store graphics image data, a color pallet 37 to convert the image data into Red, Green and Blue codes, an analog-to-digital converter 38 to convert an analog signal into a digital signal, a SCI 39 to convert a serial signal into a parallel signal, a programmable input-output chip 40 to synchronize with the parallel signal and to output the data on the bus 30, a computer 41 to count a pulse signal, and a bus 30 to connect the CPU 31 to all devices.

Details of the construction and operation of the arithmetic processing unit 10 will be explained using Figure

5 and Figure 6. As shown in Figure 5, the arithmetic processing department 10 is comprised of a user operation analysis means 50, a path account means 51, a course guidance means 52, a present position arithmetic means 55, a map match processing means 56, and a menu display means 58, representing means to effect navigation processing, such as position calculation and course guidance for an automobile.

10 The present position arithmetic means 55 respectively integrates distance pulse data measured with the wheel speed sensor 16 and angular acceleration data measured with the gyro 18, and calculates a position (X', Y') of the moving body relative to an initial position (X, Y) by integrating the distance data and the angle data during one fixed cycle time obtained by the above calculation. Furthermore, in 15 order to set an initial value of the direction of movement of the moving body, a relationship between angle data provided from the gyro 18 and an absolute direction is set by using the directional data provided from the magnetic compass 17. Furthermore, the present position arithmetic means 55 outputs current position information after having revised the sensor data with the position data provided from the GPS receiver 19 by a predetermined cycle time, whereby 20 sensor error to be accumulated is canceled by integrating the data provided from the sensor as stated above.

25 Generally speaking, in the present position information provided in this way, an error in the sensor may be still present. On this account, in order to raise the position

accuracy even more, a next map match process is performed by the map match processing means 56. The map match processing compares road data contained in the map surrounding the current position read in by a data read-in means 57 with a traveling trace obtained from the current position arithmetic means 55, whereby the current position is processed to match the road where the mutual shape relation becomes highest. By applying this map match processing in most cases, the current position comes to correspond with the road being traveled and the present position information may be output accurately.

The user operation analysis means 50 receives various operations requested from the user via the input unit 15 and controls each unit contained in the arithmetic processing unit 10 so as to execute processing corresponding to the request of the user. For example, when the user requests course guidance to a target position, processing to determine a path from the current position to the target position is performed by the path account means 51, and the information as to the guide path from the course guidance means 52 is shown to the user. When the user requests a scroll operation of the map, which is displayed through the input unit 15, a scroll display of the map domain designated is requested to a map display means 54.

The path account means 51 determines a guidance path between two spots by retrieving a node connecting an interval between two spots (the present position and goal

position) designated using the Dijkstra algorithm. When determining the path, for example, a path in which the distance between two spots becomes shortest, a course by which it becomes possible to arrive in the shortest time, a path by which the cost becomes the most economical etc., are provided by using different retrieval conditions.

The course guidance means 52 compares link information of the guidance path obtained by the path account means 51 with the present position information obtained by the position arithmetic means 55 and the map match processing means 56, and indicates to the user whether the car should turn to right or left, or go straight using an audio signal generated by the voice input and output equipment 14 before passing an intersection, or by displaying the course for the car on the map on the display unit 11.

The menu display means 58 receives a command output from the user operation analysis means 50, and a command for displaying various kinds of a requested menu is sent to the graphics processing means 59.

The arithmetic processing unit 10 has a data read-in means 57, a graphics processing means 59, a map display domain setting means 53, and a map display means 54. The map display domain setting means 53 sets a map domain that should be displayed according to an algorithm determined beforehand from the present position of the moving body output from the map match processing means 56, or from scroll information indicating a scroll direction

corresponding to scroll operation input through the user operation analysis means 50. The data read-in processing means 57 selects to read out the map data of the display domain which is set from the map memory 12. The map display means 54 sends a command to display a designated object for the map data read out, with a designated contraction scale, in a state maintaining a designated direction with respect to an upper direction of the display unit 11, to a graphics processing means 59.

The graphics processing means 59 receives the display command, formed by the map display means 54 and the menu displaying means 58, and applies the graphics image in the VRAM 36. The graphics image applied to the VRAM is managed with a color numbering, and after being converted into RGB colors corresponding to the color numbering using the color pallet 37, it is displayed by the display unit.

As shown in Figure 6, the arithmetic processing unit 10 comprises a retrieval range setting means 60, a received data analysis means 61, an icon setting means 62, an icon display location setting means 63 and an icon display means 64, operating as a processing means in a navigation system to optimize the amount of information to be communicated and to display the information received intelligibly in accordance with this invention.

The retrieval range setting means 60 sets one or more items selected by the user from items shown by the menu display means 58 as a retrieve object property, sets a

specified spot on the map provided from the scroll information as a center of the retrieve neighborhood, said scroll information relating to the present position of the moving body output from the map match processing means 56, 5 the target position of the moving body input through the user operation analysis means 50 or the direction of the scroll corresponding to the scroll operation input through the user operation analysis means 50, and sets a size of the retrieve neighborhood to a value decided beforehand. The 10 retrieve object property, the center of the retrieve neighborhood and the size of the center set in this way are sent to the information offering equipment 2 by way of the display side communication equipment 21. An example will be given for setting the information which is retrieved by the 15 user on the menu screen, by reference to Figure 8.

The center of the retrieve neighborhood which is set may be selected by using information specifying a spot, or else it is set from a position on the map. For example, a phone number and a position of the information or an address stored in the internal information memory 13 are used. The 20 inputting of the addresses is performed by using a letter input means, a place name selection means chosen from a place name list or a sound recognition means. An example of a method to set the center of the retrieve neighborhood by 25 inputting a phone number will be described with reference to Figure 9.

The retrieve neighborhood that is set may be set based

on the domain and the contraction scale of the map displayed on the display unit 11. For example, when the user is attempting to obtain information, the map domain displayed by the display unit 11 may be used as the retrieve neighborhood.

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In the above embodiment of the present invention, the size of the retrieve neighborhood is set by the information display equipment; however, it also may be set by the information offering equipment. For example, referring to the amount of information sent to the information display equipment, it may be determined to be in a range near the center of the retrieve neighborhood. Further by providing a means to set the intention of the user, a suitable amount of information may be set according to the user's intention.

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In the configuration of the above embodiment, the area size of the retrieval neighborhood is set with the information display; however, it is possible to set it with an information offering device. For example, considering the amount of information to be sent to the information display, the area size is set so that a suitable amount of information is obtained by selecting an area sequentially near to the center of the retrieval neighborhood. Furthermore, by providing a means for accommodating the wishes of the user, it may be set so that the amount of information becomes suitable for the sequentially selected area information suitable to the user.

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In the above embodiment, the retrieval range set by the

retrieval entry means 60, in other words, the key word
entered for information retrieval, is the retrieval object,
the center of the retrieval neighborhood, or the size of
retrieval neighborhood; however, since it becomes a premise
5 that the object is a business or an object that may be
utilized at a time when information is demanded for the
user, business hour information and occupancy information
may be automatically selected as the search conditions. When
such search conditions are used, the information provided by
10 the retrieval becomes to include dynamic information that is
changed with time. For example, when it is applied to the
retrieval of information concerning a service station, since
a service station which is open for business becomes the
retrieval object at the retrieval point in time, it becomes
15 possible to determine whether a service station is open for
business or not before actually going there, thereby
providing beneficial information for the user. Of course,
since unnecessary information is not communicated, the
communication line capacity may be reduced. When hotel and
20 ferry information are searched for in the same way, the date
to utilize the service may be set, thereby setting as a
search condition the existence of a vacancy on the date set.
Furthermore, information concerning information of the car
which the user is using or preference information of the
25 user may be set as a search condition. For example, when
ferry and parking lot information are searched, information
as to the size of the car may be stored. When restaurant and

service station information are searched, credit card information that the user may utilize and chain store information as to the type of store the user utilizes willingly may be set. In these cases, smooth information offering becomes possible for the user, and a reduction in the communication line capacity becomes possible simultaneously. Of course, retrieval information described as above may be combined. These items of information are set by providing setting means whenever the information is going to be obtained from the information offering device 2; however, the information may be set automatically by providing means in which the information will be registered beforehand. An example to set the preference of the user is shown in Fig. 10.

A retrieval range display means may be provided in order to show the retrieve neighborhood set as described above, and by displaying the retrieve neighborhood, it becomes possible to easily recognize the range of the map on which the information is to be displayed. In Figure 11, when the target position neighborhood is the retrieve neighborhood, an example is shown in which the retrieve neighborhood is designated by a circle. In addition to this, an arrow in Figure 11 shows the present position and a flag shows the target position. Similar designations are used in the same way in the following Figures.

When past information is provided, if a temporary memory means to store it and the retrieval range displaying

means to display the retrieve neighborhood of the information stored are provided, the amount of data communication with the information offering equipment may be reduced, since the information is judged to be already stored in the information display equipment, even if the information offering equipment isn't accessed. When the past information is displayed, the time when said information was received in said temporary memory means is displayed with the retrieve area by the retrieval range display means, and so whether said information should be obtained from said information offering equipment may be determined. An example of a case in which the retrieve area of past information is displayed with the time of receipt is shown in Fig. 12. If the information stored in the temporary memory means in addition to the above is erasable at a predetermined time point when the user has ordered it or when a predetermined time interval has passed after the power source is switched off or other information is obtained, the amount of information which needs to be stored may be prevented from 20 becoming excessively large.

In the above embodiment, the retrieve area has one center, however, plural centers may be set. For example, when several nodes which connect the target position with the present position are set as the centers of the respective retrieve areas, it looks like as that the information along a course is referred to. In other words, a problem that the user demands information many times in 25

order to obtain the information on a path disappears. When the nodes in the path from the present position to target position shown with a thick line are determined to be the centers of the respective retrieve areas, an example 5 representing the domain that became a range to be retrieved actually is shown in Fig. 13.

The received data analysis means 61 analyzes data to be provided through the display side communications equipment 21, selects several items of information contained in said 10 data, and takes out information necessary for later processing, for example, a name, location on a map, property, or affiliated information contained by respective 15 information. In analysis of data, it is necessary to know in what kind of form the data stores the information. As an example, a case of storing the information with an order decided beforehand is shown by Fig. 14. As another example, a case wherein the form of the data is contained in the data 20 is shown in Fig. 15. In the example shown in Fig. 15, in addition to the above, by storing the name, the location, and the property from the top in this order, they are stored in a form decided beforehand, the data form may be specified 25 in the data regarding only the affiliated information.

An icon setting means 62 takes out a corresponding icon from the icon memory based on the property taken out with the received data analysis means 61 so as to set it as an icon showing a representation of the information. The icon setting means 62 further has an icon presence judgment

means which judges whether the corresponding icon exists in the icon memory 20, and when the corresponding icon does not exist in the icon memory 20, the icon setting means 62 may require transmission of the corresponding icon to the 5 information offering equipment 2. Otherwise, a means to add a letter or an icon, such as an emblem, to the information sent from the information offering equipment 2 is provided and the icon may be taken out from the information sent in this way. Then, if information to show the existence of the 10 icon with the information sent is constituted to be sent simultaneously, it is understood easily that the icon corresponding to the information sent is contained therein. Figure 16 shows examples of the display of information containing an icon which has been sent from the information offering equipment and the icon provided on a map based on 15 this information.

A icon drawing location setting means 63 sets a location for the icon so that the corresponding information is displayed on a suitable location of the map based on map 20 location information retrieved using the received data analysis means 61 and information from the map display domain setting means 53. When the scale of the map changes or the map is scrolled, the location of the icon is adjusted suitably. If the data which has 25 been sent is just indicated on the map, the icons are overlapped or the information isn't confined within the screen of the display sometimes. In such a case, for

example, the scale of the map, by which the information sent is confined in the same screen is obtained, is indicated to the map display domain setting means, and resetting of the location displaying the icon may be effected by changing the 5 scale of the data display.

An embodiment for avoiding an overlap of the icons will be explained next. An overlap judgment means to judge whether there is an overlap of the icons is provided, and when it was decided that the icons will overlap, the overlap 10 information is indicated to the icon display location setting means, and the icons are set so as not to overlap mutually by adjusting the location of the icons using the icon displaying location setting means. Figures 17A and 17B illustrate an example in which an overlap of icons is avoided by resetting the location of the icons when the two 15 icons are overlapped. In a case of this example, actually, the display of the icons which are overlapped needn't be done, however, it is shown in order to describe the operation. Another method to avoid the overlap of icons may be adopted by, for example, changing the scale of the map, 20 or by changing the size of the icon.

A icon display means 64 sends a command which displays an image of the icon set by the icon setting means 62 to the graphics processing means 59 at a location set by the icon display location setting means 63. An example in which the 25 information received from the information offering equipment 2 is displayed with an icon on the map by using the

above-mentioned construction is shown in Figure 18.

In the above embodiment, as the information sent from the outside is shown with an icon on the map, the user easily understand the location relating to the information that has been sent. While making use of this feature, furthermore, in order to provide individual information, an icon property setting means 65 may be provided as shown in the following. The icon property setting means 65 sets the property of an icon, such as color and size, intensity, chrome, light on/light off, display/non-display, based on information retrieved by the received data analysis means 61. And, the icon display means 64 displays the icon based on the property set by the icon property setting means 65. When it is done in this way, the individual information, besides the location of the information according to a color of the icon, for example, may be displayed. An example will be explained using Figure 19, in which received data involves information concerning a restaurant, and a property thereof is indicated by the color which is set. For example, an icon of a restaurant which is not crowded is shown in blue (white in Fig. 19), an icon of restaurant which is available, but requires waiting for a little time, is shown in yellow (black in Fig. 19), and an icon of a restaurant which is not available without waiting a substantial time, is shown in red (dotted line in Fig. 19). When the restaurant is not available, it is meaning-less to display the icon and so the property may be changed to a

non-display mode (transparent color).

The arithmetic processing unit 10 provides navigation system processing to control the amount of information to be communicated in a suitable way according to the present invention, and to display the received information intelligibly, and has a received data/location memory means 66, an icon select means 67, an inside data retrieval means 68 and a detailed data display means 69.

The received data/location store means 66 stores each information item provided by the received data analysis means 61, and the location at which the corresponding icon should be displayed is obtained from the icon display location setting means 63 and is stored with each related information item.

The icon select means 67 decides which icon is selected by the location and the received data/location memory means 66, when detecting that the user selects one part of the screen, using the user operation analysis means 50. Then, if the icon selected is determined, the information corresponding to the icon is retrieved from the received data/location memory means 66 and is transmitted to the inside data retrieval means 68. By transmitting the location data of the icon selected with the icon select means to the path account means 51, a course guidance processing to go by way of the location with the icon which the user has selected becomes possible.

As means to detect that the user selects one part of

the screen, some methods are proposed, as follows. For example, a pointing device, such as a touch panel having many pressure sensors on the screen, may be provided so as to overlap on the screen. Otherwise, a cursor display means for displaying a cursor on the map, a cursor movement means to allow the cursor to be moved, a cursor location acquisition means to calculate the location of the cursor on the map by detecting a quantity of movement of the cursor effected by the cursor movement means, and a means to recognize the determination of the user are provided, and the user determines a location after the user moves the cursor, whereby the location selected by the user is detected. Movement of the cursor is performed by moving the cursor on the screen while keeping the map fixed, or by moving the map on the screen while keeping the cursor fixed. In the case that the cursor displayed in this way is used, the icon may be selected by detecting the location of the cursor provided by the cursor location acquisition means, on a specified icon, or the icon most near the cursor when the distance between the icon and the cursor is compared, or the icon being most near from the cursor when a distance between the icon and the cursor is compared and is less than a predetermined set value. Further, one more example of the detecting means will be explained as follows. Providing a button having a tabulation function in an input means, the icon which the user wishes to select may be obtained by changing one display property of the icon which is displayed

whenever the button is pushed. The icon which has its display property changed may be selected sequentially from the center of the screen, or by using the cursor movement input means, the icon almost being in cross course may be selected in the next selection.

The inside data retrieval means 68 obtains receipt indicating information corresponding to an icon selected by the icon select means 67, the detailed information related to this receipt information being retrieved from the internal information memory 13. As mentioned above, referring to the fact that most of the information that the navigation system utilizes is individual information that concerns location information on the map, individual information having location information which is the same as the location information on the map corresponding to a selected icon may be retrieved from the internal information memory 13. Even if there is individual information to be considered as related thereto in addition to above, the locations which should be the same as each other on the map may not actually be equal because of an error which may occur in the data processing. In this case, for example, the information as to a location which is at a distance within the degree of error being allowed and in the nearest location is selected as the individual information to be related thereto. Moreover, when the location on the map of the individual information is represented with the area, the overlapped areas are selected as the individual information

to be related thereto. Methods to search the individual information to be related thereto are provided easily in the same way; for example, the title included in the receipt information may be searched as a key word, and the 5 information common to the receipt information and the information from the internal information memory 13, such as a serial number, phone number, and address may be set as the key word for the retrieval.

A detailed data display means 69 transmits a command, 10 to display the detailed information that was retrieved by the inside data retrieval means 68, to graphics processing means 59. Otherwise, it retrieves the receipt information corresponding to the icon selected from the icon select means 67 from the received data/location memory means 66, 15 and transmits the command, to display this data, to the graphics processing means 59. Then, the received data may be displayed according to a display format contained beforehand in the received data. The detailed information taken out from the data retrieval means 68 and the receipt information 20 corresponding to the icon selected are selectively displayed according to a request from the user by a user operation analysis means 50. Otherwise, the detailed information with a disposition decided beforehand and the receipt information may be displayed so as to be overlapped. Besides, in the 25 information stored in the internal information memory 13, a method of display of the receipt information is set beforehand, and the detailed information and the receipt

information may be displayed according to this setting.

Figure 20(a) is an example in which the detailed information in the information selected and the receipt information are displayed so as to appear side by side. In the example of Figure 20(b), the icon is represented by the property and the name of the individual information, and the location of the icon is disposed in line on the screen, and it may be displayed with an icon like an image thereof on the map.

The arithmetic processing unit 10 provides a navigation system processing to control the amount of information to be communicated in a suitable way according to the present invention, and to display the received information intelligibly, and further has a select icon emphasis means 70, a detailed data display domain setting means 71 and a screen configuration change means 72.

The select icon emphasis means 70 controls the icon property setting means 65 so that the icon which the user has selected using the icon select means 67 may distinguish from other icons on the screen. The icon property setting means 65 is set so as to change the property of the icon, for example, by changing a color of the selected icon, by raising the intensity of the selected icon, by causing a flashing on and off of the selected icon, by reducing the intensity of the icon which isn't selected, or by inhibiting the display of an icon which isn't selected (transparent color). Figure 21 shows an example in which the intensity of the icon which wasn't selected is reduced.

The detailed data display domain setting means 71 sets a domain for indicating detailed data so that detailed information retrieved by the inside data retrieval means may be displayed at a location on the screen set beforehand. For 5 example, as exemplified in Figure 21, the left half of the screen is assigned as a domain for displaying the detailed data. In another example exemplified in Figure 1, the location of the selected icon is retrieved from the receive data/location memory means and a domain which does not cover 10 the location is set.

As the screen configuration changes when displaying detailed information on the screen using the detailed data display domain setting means 71, a screen configuration change means 72 sets the display domain of the map according 15 to this change, too. For example, when the detailed information is displayed on the left half of the screen, the map is to be displayed in the remaining right half. Then, when the location of the icon selected by the user is given, the screen configuration change means is set to scroll the map so that the selected icon comes into a center of the 20 right half of the screen, and the icon related to the detailed information is displayed in the central neighborhood of the map, whereby peripheral map information are easily understand. Figure 21 shows an example in which 25 an icon and the detailed information related thereto are displayed as stated above. This feature is effective for the user when the user selects one of the icons and examines the

detailed information. On the other hand, for example, when the detailed information which the user wants to watch is successively selected by the icon according to the movement of the cursor, it become difficult to watch it because
5 scrolling of the map occurs whenever the selected icon is changed. In such a case, it is better not to scroll the map even if the detailed information is displayed, and, for example, as shown in Figure 1, the detailed information is displayed so that the map remains fixed and the selected
10 icons do not overlap.

In the construction stated above, the detailed data display means 69 is provided to transmit a command, to display detailed information at a screen location set by the detailed data display domain setting means 71, to the
15 graphics processing means 59. Being constructed in this way, detailed information for an icon which a user has selected may be displayed while still displaying the icon on the map, and furthermore, the subject icon may be distinguished from other icons easily, and so a detailed information display which is very easy to understand may be provided.
20

In the above example, a case where the detailed data is larger than the domain set by the detailed data area setting means has not been considered. This is because it is expected that the information is provided particularly to a
25 driver. In other words, when a larger amount of data than the domain size is expected to be displayed, an operation to allow the displayed data to move or scroll becomes

necessary, resulting in an increased burden on the user. Actually, there are situations where it is desirable to display more data than the domain size will normally accommodate. In an example which solves this problem, the 5 detailed information is divided into several pages, each of which is smaller than the domain which is set by the detailed data area setting means, and the display means is operated to show the pages in sequence according to a request by the user, whereby the burden on the user is 10 decreased. In Figures 22(a) and 22(b), a case in which information is displayed in two pages is shown. In such a construction, it is understood easily that a scroll 15 operation requested by the user is performed only for the map. Accordingly, when the user operation analysis means detects a scroll operation request by the user, this request is processed to scroll only the map.

Furthermore, after having effected a display in accordance with the present invention as above stated, the arithmetic processing unit 10 employs a screen configuration 20 memory means 73 to return to a former display. The screen configuration memory means 73 stores how to display data on the screen according to operations by the user, such as the start of display of the received information, selection of an icon, and the closing of information display by user 25 operation analysis means 50, whereby it operates to return to the display state displayed formerly. For example, a case where the user has requested information concerning a hotel

located in a certain neighborhood or area from the information offering equipment will be explained Figure 23. If a plane map on which a present position is located at the map center is displayed on the whole screen at a point in time when the user requests the information, screen information such as "right before information request, total plane map display, present position center" is stored. In order to show the requested information, after having displayed the information concerning a hotel which has available rooms with an icon, the user pushes the "map" button so as to return to an original map screen by ending the display of the information, and so the screen information such as "right before information request, total plane map display, present position center" is transmitted to the map display domain setting means 53, and the total screen returns to display of the present position in the center of the map. In the above example, the user effects a change of the screen configuration, however, it may be assumed that change timing may be replaced after a predetermined time has passed, or it may be replaced when the velocity of the car becomes faster than a predetermined value.

The information offering equipment 2 will be explained using Figure 3. The information offering equipment 2 has a mail server 23, a WWW server 24, an internet navigation server 25, a user authentication server 26, a control unit 22, a gateway 27 and offering side communication equipment

28.

The gateway 27 has a unique address which is discriminated from other equipment connected to the network 4, it is connected with the network 4 and operates to communicate with the information offering server which is connected with the network 4, and it receives information that has been sent through network 4 to the information offering equipment 2.

The offering side communication equipment communicates with the information display equipment 1 so to send information thereto or receive information therefrom.

The mail server 23 stores electronic mail sent to a user who is able to access the information offering equipment 2 and outputs the electronic mail which is received according to a request of the user.

The WWW server 24 stores information such as a letter, a sound or a voice, a stationary drawing, and animation, according to a format decided beforehand, and provides information stored according to a request of the user.

The internet navigation server 25 stores information provided through the gateway 27 from an offering side communication device with a format decided beforehand in order to display the information on the information display 1 and outputs the information to the display 1 at the request of the user. The internet navigation server 25 receives the updating information from an information offering server, stores the received updating information in

place of the corresponding old information, and updates the information so that the information be sent to the information display 1 is renewed continuously.

5 The user authentication server 26 stores information of the user who is allowed to access the information offering equipment 2, or information to manage the service that the information offering equipment 2 may offer to every user, and is able to limit the user, or to limit the service provided to the user, who desires to effect connection
10 through the gateway 27 and the offering side communications equipment 28.

15 The control unit 22 controls the various servers 23, 24, 25, 26, the gateway 27, and the offering side communications equipment 28, and offers an electronic mail service in a world wide network, such as the internet, and a
20 WWW (World Wide Web) service etc. Furthermore, the information that the user requests is offered by processing as the information provided to the information equipment 1 is collected through the network 4, by processing as the collected information is stored in the network 4, by processing the corrected information is changed into a suitable information format in order to transmit and display it to the information display equipment, and by processing as the information demanded by the user is referred to be
25 taken out from the internet navigation server, and by processing as a retrieve result is transmitted to the information display equipment.

An example of the function performed by the control unit 22 will be explained using Figure 7. As shown in Figure 7, the control unit 22 provides for navigation system processing in which the information provided to the information display equipment 1 is collected, the amount of the information to transmitted in accordance with this invention is optimized, and the received information is displayed intelligibly for the user. The control unit 22 has an individual information reception means 80, an individual information updating means 81, a user request analysis means 82, an information retrieval means 83 and an information processing means 84.

The individual information reception means 80 receives the individual information which the information offering server has provided via the network and sends it to the information offering equipment 2 through the gateway 27.

The individual information updating means 81 stores the individual information which is received by the individual information reception means 80 in the corresponding domain of the internet navigation server.

The user request analysis means 82 analyzes the request of the user based on the data sent from the information display equipment 1 and controls each unit in the control unit in order to execute the request. For example, when the request to offer lodging availability information has been sent together with retrieve items, such as the coordinates of an object position and hotel

designation, the information is transmitted to the information retrieval means and necessary information is retrieved from the internet navigation server 25 to be transmitted to the information display equipment 1. Then, 5 registration information for the user, who is able to receive the service offered by the information offering equipment 2, is stored in the user authentication server 26, identification data of the user is obtained from the information display equipment 1, and a service that doesn't 10 fit the condition will not be executed based on this information. For example, when a service charging a fee is provided, it becomes impossible to prevent the user from escaping payment of the fee.

The information retrieval means 83 searches for 15 information that the user needs from the internet navigation server 25 according to the retrieval item that has been sent from the information display 1 and hands the search results to the information processing means 84. As mentioned above, the retrieval item sent from the information display 1 may 20 include conditions, such as a business relationship or availability for use. Such conditions may not be set in the information display 1, but the information retrieval means 83 may set it in the search condition automatically.

The information processing means 84 converts the plural 25 information searched by the information retrieval means 83 into data that the information display 1 is able to process, and hands the converted data over to the offering side

communication device 28, and so display of the retrieval information becomes possible with the information display 1. In order to realize optimization of the communicated information amount that is a distinctive characteristic of the present invention, the information which is updated with a low frequency, such as the brief description of a facility, is eliminated from the individual information to be sent to the information display 1. In addition to the above, according to the environment of the information display, for example, whether the moving body is moving or is stopped, the communicated information amount changes so that intermission of the communication line changes, and the reduction of the information may be executed by judging the change. For example, as it is possible to understand whether the moving body is moving or not may be shown with the information display 1, and the information offering device 2 is notified of the effect when stopping, and the information processing means 84 is operated to not control the information reduction.

The information processing means 84 may be operated to change the amount of the information to be transmitted to the information display 1. For example, the maximum amount of the information to be transmitted may be set beforehand, the communicated information amount sent at one time is set to not exceed the maximum amount, or a processing to establish the size of the image is performed when the image data is sent. Moreover, the data reduction process as

mentioned above is based on obtaining information such as the situation of the information display 1, for example, whether the car is running or not, the communications means is PHS or a cellular phone, and the display 11 of information display 1 is large or small.

The above configuration example is based on the premise that the information is sent from the information offering server 3. However, a configuration of the control unit 22 that is able to demand individual information will be explained for a case where the information offering equipment 2 directly accesses the information offering server 3. The control unit 22 has a server information store means 85, a retrieve object server setting means 86 and an individual information request means 87 for this purpose.

The server information store means 85 stores information, such as the kind and contents, address, and access method of the information that may be offered by every information offering server 3.

The retrieve object server setting means 86 sets the information offering server 3 in order to obtain the information necessary for the internet navigation server 25 based on the information stored by the server information store means 85. Then, in a case where the user request analysis means 82 is operated to obtain information by accessing the information offering server 3 at a point in time when the user requests information, the information offering server 3 which is able to offer the information

requested by the user may be retrieved so as to be set. When
constructed in this way, since it becomes possible to access
the specific information offering server 3 which is able to
provide the information which is necessary, the burden on
5 the network may be reduced.

The individual information request means 87 accesses
the information offering server 3 set as the retrieve object
and outputs the request to offer the information. The timing
for requesting an information offering may be obeyed to the
10 indication by a timer which promotes a request starting in a
time set previously, or the user request analysis means 82
operates to obtain the information by accessing the
information offering server 3 at the point in time when the
user requests the information, and the timing may be a point
15 in time when the retrieve object server setting means 86
sets the retrieve object server.

In the example constituted above, it is a premise that
the information that has been sent from the information
offering server 3 is respectively optimized. In the
20 information offering equipment 2, a construction which make
the information stored in the internet navigation server 25
most suitable will be explained. The control unit 22 has a
fixed form format setting means 88 and a selection object
data setting means 89 for this purpose.

25 The fixed form format setting means 88 sets a format of
the information stored in the internet navigation server 25,
and makes it possible for the individual information

updating means 81 to update the information of the internet navigation server 25 according to this format. For example, as shown in Figure 14, the format is provided to fit the information display equipment 1.

5 A selection object data setting means 89 establishes whether the information is renewed according to the various properties of the information and makes it possible for the individual information updating means 81 to update the information of the internet navigation server 25 according 10 to this setting. For example, if the information sent from the information offering server is divided into several files, an extent that may be stored in the internet navigation server is set utilizing the extent determined depending on the property.

15 In the above embodiment, the information offering equipment 2 is constituted to send information into the information display equipment 1, however, the internet navigation server is one kind of the server too. Therefore, a construction wherein the user on the internet accesses the 20 information on the internet navigation server may be provided, or another construction wherein the user of the information display equipment 1 accesses the server on a network other than the information offering equipment 2 through this information offering equipment 2, may be 25 provided.

Because, the information is sent from an information offering server connected through a network when the

information is updated, if the information sent is stored, the latest information may be stored. Furthermore, since the necessary information may be obtained by accessing the necessary information offering server at a timing desirable to the user, the latest information may be accessed in this case too. Relating to the information provided to the user and sent from the information offering equipment to the information display equipment, the amount of the data is reduced to that needed, thereby it becomes possible to transmit the information in a short time, or communication by using a cellular telephone system becomes possible.

The information that is sent from the information offering equipment is displayed with an icon on the corresponding map by using icon location information, so that the location of the information is easily understood, and because only the icon is displayed, the concentration of the user isn't needed, and so it is easy for the driver to understand it. Because the detailed information of the corresponding information is displayed by selecting an icon which is displayed, the user may get the needed information with a minimum of operation and with a good retrieval efficiency. When there is detailed information in the information display equipment, it is possible to provide enough information for the user by showing the detailed information, and as there is no need to send the detailed information from the information offering equipment, the amount of data being transmitted decreases, and so it

becomes possible to transmit the data in a short time,
whereby the cellular telephone system becomes even easier to
use.